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CURRANT LEAF SPOT CONTROL

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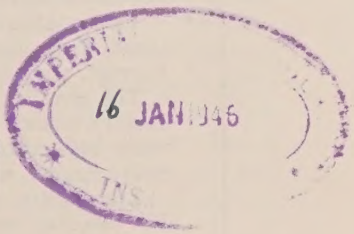

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ABSTRACT

LEAF SPOT as it occurs in New York State may be caused by *Pseudopeziza ribis* Kleb., which is the most prevalent organism, or by *Mycosphaerella grossulariae* (Fr.) Lindau. Leaf spot is the most widely distributed disease of currants in the State.

Experiments on the control of leaf spot were conducted from 1939 to 1944, inclusive. Bordeaux mixture 3–3–100 gave as effective control as 8–8–100.

The addition of 1 pint of S.E.C. oil to the 3–3–100 bordeaux mixture gave increased efficiency. Of the eight spreader-stickers tested, Spraysoy A and rosin fish oil soap were also satisfactory for use with bordeaux, but were not as effective as the S.E.C. oil.

Two applications of the fungicide, one about three weeks after bloom and the other after harvest, were sufficient to give control.

The nine insoluble coppers tested gave satisfactory results when S.E.C. oil was added. They were not superior to the bordeaux mixture at equal copper concentration.

The control obtained with Fermate, U.S.R. No. 604, and wettable Spergon was poor. Lime-sulfur was not effective. Limited tests with insoluble copper dusts containing 7 per cent copper did not give control of leaf spot.

The best control was obtained with two applications (one three weeks after bloom and the other after harvest) of 3–3–100 bordeaux mixture with 1 pint of S.E.C. oil.

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CURRANT LEAF SPOT CONTROL

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INTRODUCTION

Leaf spot is the most widespread disease of currants in New York State. About 85 per cent of the leaf spot is caused by *Pseudopeziza ribis* Kleb., which is often referred to as anthracnose, while 15 per cent is caused by *Mycosphaerella grossulariae* (Fr.) Lindau.

The premature defoliation of currant bushes by leaf spot weakens the plants and results in lower yields, shorter life of the planting, and increased possibility of winter injury.

Marsh and Maynard (8)[1] reported that bushes sprayed for the control of *P. ribis* showed increased vigor, 15 per cent heavier buds, and an increase in yield of 26 per cent when compared with bushes on which the disease was not controlled.

The usual spray schedule for currant leaf spot control has suggested five applications of bordeaux mixture 8–8–100 or lime sulfur 2½–100 (4). Most growers objected to the number of applications and were concerned about the visible spray residue on the currants following the use of the 8–8–100 bordeaux mixture. Some growers who had used lime-sulfur reported that the leaf spot control was not satisfactory.

Investigations were started by the writer in 1939 to determine a satisfactory concentration of bordeaux mixture, the minimum number of spray applications required, the efficiency of insoluble coppers, the advisability of using spreader-stickers, and if lime-sulfur was of any value for the control of leaf spot. Preliminary reports were presented as the work progressed (11, 12, 13, 14). Following the publication of these preliminary reports, the suggested spray schedule for currant leaf spot control was revised (9).

This bulletin gives the results of experiments conducted in the Hudson Valley and western New York during the past six years on the development of an efficient and economical spray schedule for the control of leaf spot on currants.

[1]Figures in parenthesis refer to Literature Cited, page 13.

MATERIALS AND METHODS

All tests for currant leaf spot control were conducted on the Wilder variety, except for the 1939 experiment when the name of the variety used was unknown. Each individual test consisted of duplicate plats of 30 bushes each which were randomized. In the 1944 tests, four replicates of 30 bushes each were employed.

The bordeaux mixture used was prepared by washing the snow-form copper sulfate thru the screen into the tank full of water. After 2 or 3 minutes, during which time the agitator was running, the hydrated spray lime was washed thru the screen. The insoluble coppers and other dry fungicides were washed thru the screen into the tank of water to give a satisfactory suspension of the materials. When spreader-stickers were included they were always the last ingredient to be added to the tank of spray mixture.

The sprays were applied with a two-nozzle broom at a pressure of 300 pounds. The rows of bushes were sprayed from both sides. Particular attention was given during spraying to obtain a thoro coverage on the under side of the leaves since Blodgett (2) has shown that most of the infection occurs thru the lower surface of the leaf. Normally, the sprays were applied at the rate of about 250 gallons per acre.

The percentage of defoliation was used to indicate the disease occurrence in the various plats. The amount of defoliation in each bush was graded according to the following scale: 0, none; 1, trace; 2, slight; 3, moderate; 4, severe; 5, complete. After the bushes in a plat were scored, the defoliation index was obtained by multiplying the number of bushes in each grade by the numerical rating of the grade, adding each of these products, and then dividing the sum by the total number of bushes in the plat. The index was multiplied by 20 to give the percentage of defoliation.

EXPERIMENTAL RESULTS

EFFICIENCY OF FUNGICIDES

Thruout these investigations no attempt was made to obtain perfect control of the leaf-spot fungi. The object was to retain a sufficient amount of foliage on the bushes with a minimum number of spray applications and the lowest effective concentration of the fungicide so that the bushes would make normal growth. It was considered that satisfactory control of leaf spot was obtained if not more than 40 per cent defoliation had occurred by September 15.

Since Marsh and Maynard (8) had reported that one application of 4–8–100 bordeaux mixture made immediately after harvest would control leaf spot, it was decided that the best procedure would be

to start the tests with one application of the fungicides, and increase the number of applications, if advisable, rather than to start with the recommended five applications (4) and reduce the number.

In 1939, one application of bordeaux mixture 4–4–100 and Cuprocide 54–Y 2–100 was made on August 1. A significant reduction in the amount of defoliation was obtained (Table 1). When S.E.C. oil was added to the Cuprocide 54–Y, a further reduction in defoliation resulted.

During 1940, experiments were conducted on three farms (Nos. 1, 2, 3) in the Hudson Valley and on one farm (No. 4) in western New York. At farm No. 1, where one application of the spray treatments was made, the control of leaf spot was not as good as that obtained at the other three farms where two applications of the spray treatments were made (Table 1). Bordeaux mixture 3–3–100 was as effective as the 8–8–100 formula and did not cause an objectionable spray residue on the fruit. The insoluble coppers in general gave control equal to that of the bordeaux. Since only two applications of the fungicides were made thruout the season, S.E.C. oil was added to the insoluble coppers to increase their retention on the foliage. Lime-sulfur was definitely inferior to the copper fungicides for the control of leaf spot.

Observations made during 1939 showed that considerable leaf spot occurred during June; therefore, it would appear that one spray application made after the fruit was picked would not give satisfactory control. This was substantiated by the results obtained in 1940. Consequently, it was decided that future experiments would consist of two spray applications, the first to be made in early June and the second after harvest which varied from July 15 to August 1.

Good control of leaf spot was obtained with the copper fungicides in 1941, even tho the insoluble coppers were used at one-half the concentration employed in 1940 (Table 1). Fermate at 1–100 with lime ½–100 was significantly less effective than the copper materials. The addition of S.E.C. oil to the Fermate-lime spray did not increase the control to any extent. As indicated by the amount of defoliation in the nonsprayed plats, leaf spot was not as prevalent in 1941 as it was in 1940.

Leaf spot was generally severe in 1942. All of the materials tested except wettable Spergon showed satisfactory control (Table 1). Copper oxychloride-sulfate and Fermate were inferior to the other copper fungicides tested that year. The addition of S.E.C. oil to the

TABLE 1.—EFFICIENCY OF VARIOUS FUNGICIDES FOR THE CONTROL OF CURRANT LEAF SPOT.

FUNGICIDE	FORMULA	PERCENTAGE OF DEFOLIATION							
			1940						
		Sept. 22, 1939	Sept. 20, Farm No. 1	Sept. 21, Farm No. 2	Sept. 22, Farm No. 3	Sept. 25, Farm No. 4	Sept. 12, 1941	Sept. 8, 1942	Sept. 10, 1943
Nonsprayed	———	63.0	89.4	70.6	79.2	78.6	56.0	96.3	97.0
Bordeaux mixture	8–8–100	—	45.4†	—	38.2	—	—	—	—
Bordeaux mixture	4–4–100	39.5†	—	—	—	—	—	—	—
Bordeaux mixture	3–3–100	—	45.4†	7.4	37.0	29.2	9.4	21.4	43.9
Bordeaux mixture	3–3–100*	—	—	—	—	—	—	12.0	16.0
Yellow Cuprocide	½–100	—	—	—	—	—	9.8	—	—
Yellow Cuprocide	½–100*	—	—	—	—	—	8.0	—	—
Yellow Cuprocide	10 oz.–100*	—	—	—	—	—	—	20.0	62.4‡
Yellow Cuprocide	1–100*	—	49.0†	—	32.6	28.4	—	—	—
Cuprocide 54Y	2–100	40.0†	—	—	—	—	—	—	—
Cuprocide 54Y	2–100*	32.0†	47.6†	10.0	34.0	27.4	—	—	—
Bordow	4–100*	—	—	—	—	30.0	—	—	—
Tennessee 34	2–100*	—	—	11.2	—	20.2	—	—	—
Basicop	2–100*	—	—	—	—	24.8	—	—	—
Copper Compound A	2–100*	—	42.8†	11.6	—	37.2	—	—	—
Coposil	2–100*	—	52.6†	—	45.6	29.0	—	—	—
Tribasic copper sulfate	1–100*	—	—	—	—	—	—	22.3	53.6‡
Copper oxychloride-sulfate	1–100*	—	—	—	—	—	8.6	30.7	51.4‡
Lime-sulfur	2–100	—	—	43.4	64.5	67.2	—	—	—
U. S. R. No. 604§	1–100*	—	—	—	—	—	—	—	57.0
Spergon (wettable)	4–100*	—	—	—	—	—	—	63.0	—
Fermate + lime	1–½–100	—	—	—	—	—	35.0	—	—
Fermate + lime	1–½–100*	—	—	—	—	—	32.2	—	—
Fermate	1–100*	—	—	—	—	—	—	32.3	91.8
Minimum Significant Difference (19:1)		7.3	7.9	9.8	15.9	5.8	10.5	7.5	12.2

*S.E.C. Oil (self-emulsifying cottonseed oil), 1 pint to 100 gallons used as spreader- sticker.

†Only one application of the fungicides made after harvest. All other plats received two applications, the first in early June, the second after harvest.

‡Rosin fish oil soap used as spreader-sticker.

§2, 3, dichloro-naphthoquinone.

3–3–100 bordeaux mixture resulted in a significant reduction in the amount of defoliation when compared to that which occurred when the bordeaux was used alone. The even coverage of the spray material obtained when the S. E. C. oil was added reduced the visibility of the bordeaux residue on the fruit.

The percentage of defoliation at different dates during the 1942 season is of interest. In the 1942 trials the first application was made on June 16 and the second application on July 15. As shown in Fig. 1,

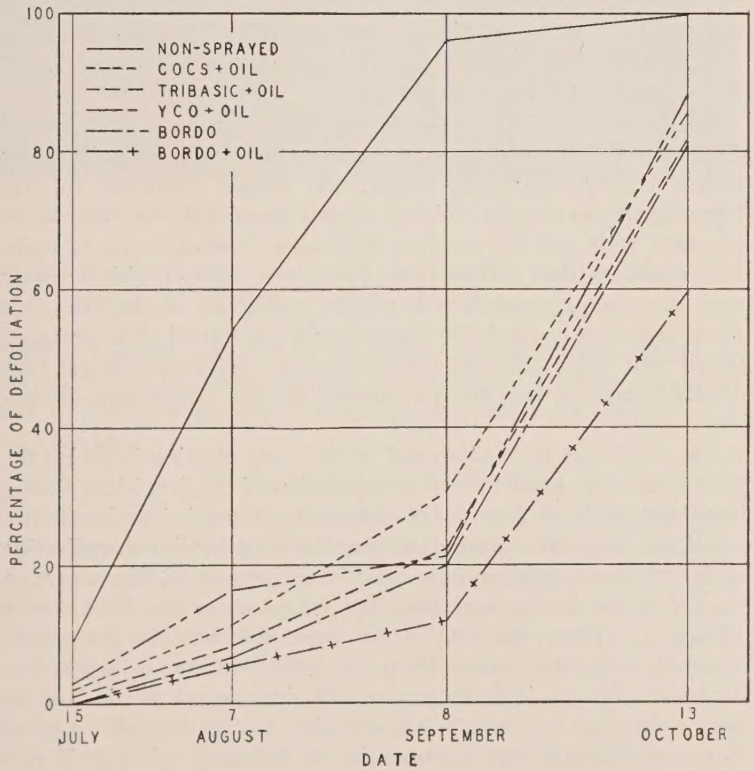

FIG. 1.—THE PERCENTAGE OF DEFOLIATION IN SPRAYED AND NONSPRAYED CURRANT PLATS AT INTERVALS DURING THE 1942 SEASON

COCS + oil = copper oxychloride-sulfate 1–100 plus 1 pint S.E.C. oil. Tribasic + oil = Tribasic copper sulfate 1–100 plus 1 pint S.E.C. oil. YCO + oil = Yellow Cuprocide 10 ounces to 100 plus 1 pint S.E.C. oil. Bordo = bordeaux mixture 3–3–100. Bordo + oil = bordeaux mixture 3–3–100 plus 1 pint S.E.C. oil.

the nonsprayed plats were practically defoliated by September 8, while none of the sprayed plats showed as much as 40 per cent defoliation before September 15. There was no significant difference between the spray treatments on August 7 (M.S.D., 19:1 = 8.7).[2] On September 8, the copper oxychloride-sulfate was poorer and the bordeaux mixture 3–3–100 with S.E.C. oil was better than the other treatments (M.S.D., 19:1 = 7.5). The final data for October 13 showed that the bordeaux mixture with S.E.C. oil was superior (M.S.D., 19:1 = 2.3). Even tho the majority of the plats in the 1942 tests showed about 20 per cent defoliation on September 8, Fig. 2 shows that there was a striking difference between the sprayed plats and the rest of the planting which was not sprayed.

During 1942, preliminary trials were made on the possible use of dusts for the control of leaf spot. Sufficient amounts of tribasic copper sulfate, copper oxychloride-sulfate, and yellow Cuprocide to give 7 per cent copper in the finished dusts were mixed with 10 pounds of wheat flour and the required quantity of Loomkill talc to make 100 pounds of dust. These three dusts were applied with a rotary type hand duster under suitable weather conditions on the dates that the sprays were applied. On September 8 the dusted plats averaged 88 per cent defoliation, while the nonsprayed plats were 96 per cent defoliated and the best spray treatment showed 12 per cent defoliation.

The 1943 tests were conducted in the same planting in which the 1942 trials were made. The first application of the fungicides should have been made on June 5, but due to travel restrictions it was not possible to apply the sprays until June 9. The delay in the application of the first spray apparently resulted in an increase of 22 per cent in the defoliation in the bordeaux plats compared to the 1942 results (Table 1). There was only 4 per cent difference in the results obtained in the two years when the S.E.C. oil was added to the bordeaux mixture, indicating more effective control. Rosin fish oil soap which was used as a spreader-sticker for the insoluble coppers threw the materials out of suspension in the spray mixture. Therefore, two additional factors influenced the performance of the insoluble coppers, poor timing of the first application and poor physical condition of the spray mixture in the tank. A comparison of the results obtained with the insoluble coppers in 1943 with those obtained in 1942 shows that the 1943 results were not satisfactory.

[2]M.S.D. = Minimum significant difference at odds of 19:1.

FIG. 2.—VIEW OF A PORTION OF THE LEAF SPOT CONTROL PLATS, SEPTEMBER 8, 1942.

On the left, sprayed rows; on the right and beyond sprayed rows is the non-sprayed portion of the planting.

Neither Fermate nor U.S.R. No. 604 gave satisfactory control of leaf spot. The bordeaux mixture 3–3–100 with S.E.C. oil was the only treatment which gave effective control under the conditions of the 1943 tests.

EFFECT OF SPREADER-STICKERS

The addition of a spreader-sticker, such as S.E.C. oil, to the 3–3–100 bordeaux mixture gave a significant reduction in the percentage of defoliation (Table 1). S.E.C. oil is not commonly used by most growers so it was advisable to test other spreader-stickers to determine if they might be satisfactory to use with the bordeaux mixture.

During 1943 and 1944, tests with eight spreader-stickers in combination with the 3–3–100 bordeaux were made in the same currant planting. The data indicate that the S.E.C. oil was superior to the other materials considering the results from both years (Table 2), while Spraysoy A and rosin fish oil soap were next best. The other five spreader-stickers did not give better control than the bordeaux mixture alone. It is to be noted from the data in Table 2 that the defoliation which occurred in the various sprayed plats is greater than that which resulted in the tests during previous years, except for 1943 (Table 1). In both 1943 and 1944, the first application of

the spray treatments should have been made from 5 to 7 days earlier, but as previously mentioned, this was not possible.

The percentage of defoliation recorded in 1944 was greater than that for 1943 (Table 2). It will be noted that the data were taken on September 10 in 1943 and on October 4 in 1944. Reference to Fig. 1 shows that after about September 8 the defoliation in the sprayed plats increased rapidly due to the normal autumn leaf fall. The difference between the defoliation on September 10 and October 4 is about 30 per cent in the case of the plats sprayed with bordeaux mixture and S.E.C. oil. Since the 1944 records were taken in October, it is probable that they are about 30 per cent greater than if they had been taken on September 8, which is the date on which the 1943 records were taken. If the 30 per cent difference is considered, the data for 1943 and 1944 are in close agreement.

TABLE 2.—EFFECT OF SPREADER-STICKERS ON THE EFFICIENCY OF BORDEAUX MIXTURE 3–3–100 FOR THE CONTROL OF CURRANT LEAF SPOT.

SPREADER-STICKER	AMOUNT PER 100 GALLONS	PERCENTAGE OF DEFOLIATION	
		Sept. 10, 1943	Oct. 4, 1944
Nonsprayed	———	97.0	100.0
None	———	43.9	72.0
S.E.C. oil*	1 pint	16.0	55.1
Spraysoy A	8 oz.	46.5	64.1
Rosin fish oil soap	1 lb.	46.5	68.7
Grasselli spreader-sticker	4 oz.	56.0	80.4
Triton B-1956	4 oz.	77.2	82.5
Kerosene emulsion†	1 qt.	65.6	—
Summer oil‡	1 qt.	75.0	—
Liquid Orthex	1 pt.	78.2	—
Minimum Significant Difference (19:1)		12.2	1.9

*Also available under the trade name "Veg-Oil."
†Kerosene emulsion prepared by adding 1 part of sulfonated oil (Nopco 1316–V) to 4 parts of kerosene.
‡A 45-second viscosity oil to which 4 per cent of Triton B–1956 was added. Obtained from Rohm and Haas Company, Philadelphia, Pa.

Kerosene emulsion, summer oil, and Liquid Orthex were not used in the 1944 tests since leaf injury occurred in 1943 in those plats in which a type of mineral oil was used as a spreader-sticker. This injury was characterized by a yellowing of the margins of the leaves.

It was again observed during these tests that the addition of spreader-stickers to the bordeaux mixture resulted in a more uniform deposit of the spray material on the fruit and foliage which reduced

the visibility of the spray residue to a minimum. The lack of apparent spray residue is important from the grower's standpoint.

DISCUSSION

A survey of the suggested spray schedules for leaf spot control in various parts of the United States shows that there are differences in the recommendations (1, 2, 3, 5, 6, 7, 10, 16). The number of recommended spray applications varies from two to five and in most cases the last application is made after the currants are picked. Various concentrations of bordeaux mixture, ranging from 10–10–100 to 4–6–100, are listed. In no case is the use of a spreader-sticker with the bordeaux mixture mentioned. In two cases (1, 7) lime-sulfur is suggested as an alternate fungicide. In another instance (5) a split schedule of lime-sulfur and bordeaux mixture is recommended, which would be more applicable to gooseberries than currants. These schedules are used in regions where conditions are probably different than those in New York State.

Under New York conditions two applications of the fungicide have been sufficient to control leaf spot. As indicated by the experience with the 1943 and 1944 tests, the timing of the first spray is important. During most seasons, June 1 would be a satisfactory date. However, the bushes should be observed, beginning about May 15, and if any of the lower leaves or those in the center of the bush start to show leaf spot, it is time to make the first application. The second spray should be applied immediately after harvest. The timing of the first application is particularly important. The fungi which cause the leaf spot live over winter in the dead, diseased leaves on the ground. About the middle of May, the fungi become mature and produce ascospores which infect the leaves during rainy periods. The first application is made to control this primary infection. After the spots have developed on the leaves, conidia are produced which spread the disease to other leaves during the summer. The second application is made to control the secondary spread of the leaf spot.

Considering spray residue, the best concentration of bordeaux mixture was 3–3–100. This concentration controlled the leaf spot as readily as the higher concentrations if thoroly applied to both surfaces of the leaf. The visibility of the spray residue was reduced greatly if a spreader-sticker was used with the bordeaux mixture to give a more uniform deposit of the spray material. The use of the best spreader-sticker also increased the control obtained.

A total of nine insoluble coppers were tested during the investigation. If they were used at a copper concentration equal to the 3–3–100 bordeaux and with S.E.C. oil, the control of leaf spot was usually satisfactory. Rosin fish oil soap is not a satisfactory spreader-sticker to use with the insoluble coppers unless lime or lead arsenate is also in the spray mixture since the insoluble coppers alone may be thrown out of suspension and accumulate in the foam. S. E. C. oil is the best spreader-sticker for use with the insoluble coppers.

At various times during the experimental work such insecticides as nicotine sulfate, rotenone, and lead arsenate were added to the spray mixture. No deleterious effect was caused by the addition of the insecticides.

SUMMARY AND CONCLUSIONS

Leaf spot as it occurs in New York State may be caused by *Pseudopeziza ribis* Kleb., which is the most prevalent organism, or by *Mycosphaerella grossulariae* (Fr.) Lindau. Leaf spot is the most widely distributed disease of currants in the State.

In experiments conducted during the past six years, various concentrations of bordeaux mixture, nine insoluble coppers, three organic fungicides, and lime-sulfur were tested for their efficiency in leaf spot control. In general, the copper fungicides gave a satisfactory control of leaf spot, while the organic fungicides and lime-sulfur were not effective.

The addition of certain spreader-stickers to the bordeaux mixture increased disease control. Of the eight tested, S.E.C. oil was the best, while Spraysoy A and rosin fish oil soap were the only other satisfactory materials.

The apparent spray residue on the currant fruit was reduced to a minimum by the use of low-dosage bordeaux mixture with a suitable spreader sticker. The insoluble coppers did not cause an objectionable spray residue.

Preliminary tests with three insoluble copper dusts containing 7 per cent copper did not show satisfactory control of leaf spot.

The best control of leaf spot was obtained with two applications of bordeaux mixture 3–3–100 with 1 pint of S.E.C. oil. The first application was made about June 1, when leaf spot was first noticed, and the second in July immediately after the fruit was picked.

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